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Article XXXV.—ON THE COTYLOSAURIAN GENUS *PANTYLUS* COPE.

By Robert Broom.

Considering that the specimens of *Pantylus* in the American Museum have been described by Cope and redescribed by Case, and more recently further examined by v. Huene, and that the only other known specimen has been described by Mehl it might be thought superfluous to add yet another description, but as *Pantylus* is a very remarkable aberrant type, so different from all other known forms that Case establishes for it a distinct Suborder, and as the published descriptions differ from one another in a number of important points, and as the only two authors, Mehl and v. Huene, who have described the lower jaw have in my opinion misunderstood the structure, the following further studies will not seem unnecessary.

The upper side of the skull has been figured by Cope, Case, and v. Huene, and the greater part also by Mehl. As in the type specimen nearly every suture can be made out with the greatest ease as pointed out by v. Huene there is little room for differences of opinion except in interpretation. There is one point however where I incline to differ from Cope, Case, and v. Huene that is in regard to the sutures of the bones of the temporal region. All these authors agree in regarding certain markings on the matrix of the right temporal region of the type specimen as the sutures between the bones which have been weathered off. They certainly look extremely like sutures, but in my opinion they are the marks of cracks in the somewhat crushed temporal roof. And this conclusion is borne out by the fact that they do not agree with the sutures which are preserved on the other side of the skull. I give a restoration of the upper surface of the skull with the sutures as I trace them and with the slight distortion of the skull due to crushing corrected. I fail to find any pineal foramen, though it is figured by Cope, Case and

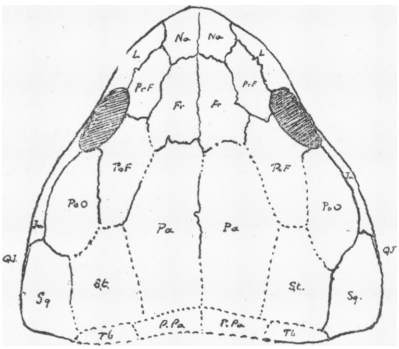

Fig. 1. Skull of *Pantylus cordatus* Cope. About ⅓ nat. size. All the sutures in line are I think beyond question. The tabulare is drawn from spec. No. 4331.

v. Huene. The only important differences of my figure of the top of the skull from those of the previous authors is in the smaller size of the "supratemporal", the larger size of the postfrontal and the presence of a tabulare.

The parietals are very large and most probably there were behind them small postparietals as in *Captorhinus*. The tabulare is well seen in specimen No. 4331. It is moderately large and shows much more on the occiput than on the upper surface of the skull. It largely overlaps the occipital plate of the squamosal. And the suprasquamosal also overlaps the squamosal.

The pterygoid does not differ very greatly from the Rhynchocephalian type as seen in *Procolophon* and *Captorhinus*. There is a very deep posterior process as pointed out by v. Huene which has a broad articulation with the large quadrate. There is a large articulation for the basisphenoid process, and entering into the same articulation is the base of the epipterygoid. The epipterygoid is short and broad and very unlike the long narrow columella cranii of *Procolophon*.

The specimens in the American Museum do not add much to our knowledge of the anterior part of the palate. No. 4330 shows however the narrow pterygoid curving forward inside of the large palatine, and confirming Mehl's drawing. There are numerous small teeth on the pterygoid which extend backwards as far as the basisphenoid articulation. The teeth are much more numerous than indicated by Mehl, there being about five rows of them. The palatine teeth also extend far back, the palatine bone fitting into the pterygoid and also nearly reaching the basisphenoid articulation. I don't find any evidence of a transpalatine bone.

The lower jaw is quite as interesting as the rest of the skull. Neither Cope nor Case have made any endeavor to elucidate the structure of the mandible. But Mehl who had nearly both jaws complete has figured them and given a view of a transverse section across the tooth bearing portion. He does not describe the structure of the jaw in any detail, but clearly shows that most of the teeth are not borne by the dentary but by another bone which he believes to be splenial.

V. Huene figures and briefly describes the jaw but most unfortunately by taking the imperfect left ramus in the American Museum to be the right he has misunderstood the structure and most of his determinations of the bones are thus erroneous.

As described by Case and Mehl the jaw is broad and flat. Its lower surface is ornamented somewhat after the fashion of the bones of the top of the skull. Near the articular end the ornamentation becomes less marked, and the inner side of the jaw is smooth. At first sight the structure of the jaw looks puzzling but as all the sutures can be easily made out the peculiarity is seen to be merely due to the unusual development of certain elements, and the marked flattening from above downwards.

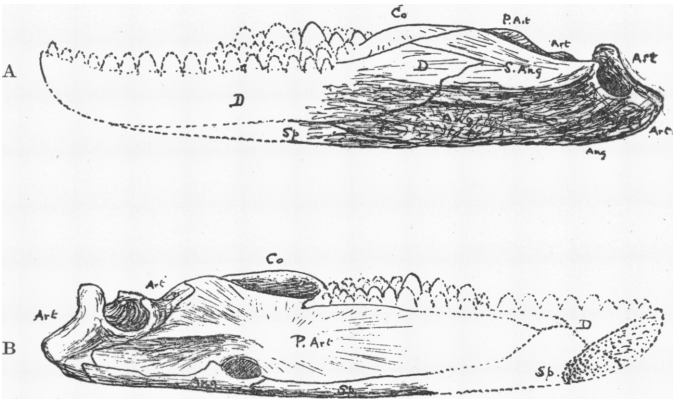

Fig. 2. Left mandible of *Pantylus cordatus* Cope. Nat. size. A. Direct outer view. B. Direct inner view. *Ang.*, Angulare; *Art.*, Articulare; *Co.* Coronoid or Complementare; *D.*, Dentary; *P. Art.*, Prearticulare or Goniale; *S. Ang.*, Surangulare; *Sp.*, Splenial or Operculare.

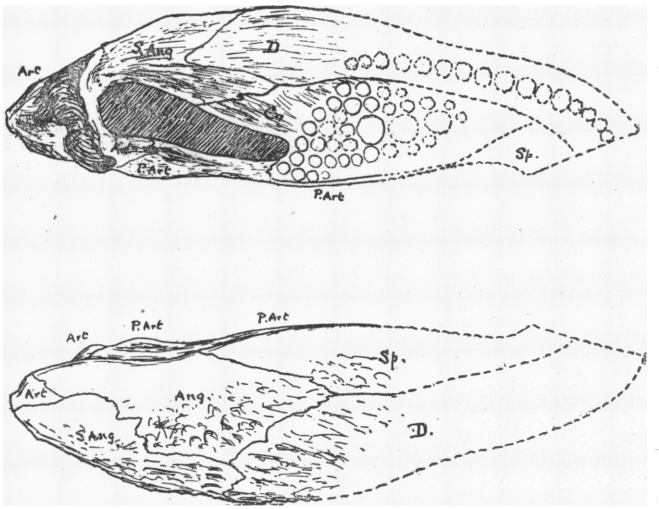

Fig. 3. Direct upper and lower views of left mandible of *Pantylus cordatus* Cope. Nat. size. Lettering as in Fig. 2.

Concerning the dentary there can be no difference of opinion. It is the large bone which forms most of the outer and lower portion of the front half of the jaw. As seen by Mehl's figures and in the American Museum specimens it has a single row of blunt teeth. Internal to the tooth bearing part of the dentary lies the bone which bears the greater number of teeth. By both Mehl and v. Huene this is stated to be the splenial, but with this conclusion I disagree. The Splenial in all reptiles must be the bone which is homologous with the splenial of the crocodile. Watson has recently traced the homologies of this bone through most reptiles and down through the Stegocephalians to the Crossopterygians. It may be described as the bone which lies on the inner and lower side of the jaw in front and serves mainly as a splint to unite the dentary with the angular or other bones behind. In the large majority of types it unites with its neighbor in front to form the lower part of the symphysis of the jaw. It has been correctly identified by v. Huene in *Captorhinus* and other primitive types. When we look for

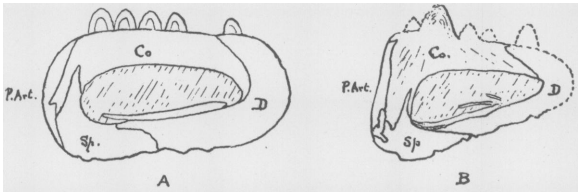

Fig. 4. Sections across the mandible near the middle of the dentary of *Pantylus cordatus*. A. Modified after Mehl. Section of the jaw of the Chicago specimen possibly a different species. About ⅔ nat. size. B. Section of the jaw of one of the New York specimens. Slightly enlarged.

such a bone in *Pantylus* we find without difficulty a typical splenial in the usual situation. It comes rather more to the outer and under side than in most higher reptiles, but as pointed out by Watson this is a character of the early types and is seen especially in the Stegocephalians. It has a long suture with the dentary and posteriorly meets the angular on the lower and outer side, and the prearticular on the inner side. In Mehl's section which I reproduce there are two elements on the inner side which he was doubtful about and left the sutures in dotted line. The sutures are perfectly correctly traced, and agree closely with those in the sections shown in the Am. Mus. specimens. The lower and inner bone is the splenial. The flat one forming the whole inner side of the jaw is the prearticular, and the large bone above which bears the majority of the teeth is the coronoid.

There is I think as little doubt about the identification of the coronoid as about the splenial. It lies between the prearticular and the dentary and it

forms the anterior border of the supra-meckelian fossa. It thus not only agrees with the bone that is called coronoid or complementare in most reptiles but it also agrees with the coronoid of the Stegocephalians. In *Eryops, Trimerorachis* and many other amphibians the coronoid has a further resemblance to that of *Pantylus* in bearing teeth. The relations of the coronoid to the surangular, angular, dentary and prearticular are seen in the figures I give of the Am. Mus. jaw. The anterior part of the bone is not seen in any of the Am. Mus. specimens but is partly restored from Mehl's drawings retaining the suture Mehl has identified as lying between the coronoid and dentary and adding the probable sutures between the splenial and the coronoid and dentary.

In the cavity of the jaw as figured by Mehl there is a flat bony plate. In the section of the jaw of Am. Mus. spec. No. 4331 the same bony plate is seen, but in the section of the jaw near the same level in spec. No. 4330, there is no such plate to be seen. On the other hand a section through the jaw near the corresponding region in the Stegocephalian *Zatrachis microphthalmus* a similar plate of bone is seen in the cavity of the jaw. V. Huene suggests that it may be the tip of the prearticular; but this is impossible since the undoubted prearticular is the bone lying along the inner side of the middle of the jaw. There is practically no evidence as to what it is, though much as to what it is not.

The prearticular is a large bone which extends from behind the articulation to at least the anterior third of the jaw. It is for the most part smooth and slightly curved. It articulates above with the coronoid, and forms about three quarters of the inner border of the supra-meckelian fossa. At its lower edge a little distance in front of the plane of the articulation is a large foramen doubtless homologous with the similarly situated foramen in *Eryops* and *Trimerorachis*. The lower border of the bone is in contact with the angular and splenial, and posteriorly it articulates with the articular. In front of the lower border of the articulation is a well marked ridge which extends forwards to opposite the middle of the foramen.

The angular is a moderate sized bone situated very similarly to the angular in the Stegocephalians. It articulates above with the dentary and surangular, and below and internally with the splenial and the prearticular, and posteriorly with the articular. Its outer and upper half is coarsely sculptured.

The surangular is quite as large as the angular, and relatively much larger than in most reptiles. It forms about half of the outer border of the suprameckelian fossa and its upper part articulates in front with the coronoid and the dentary. Below it has a large articulation with the angular, and posteriorly it is anchylosed to the articular. Its lower half is coarsely sculptured.

The articular is relatively small though it has a very broad articular surface. The articulation has an outer and inner part divided by a very prominent ascending process from the back part, which must have made it quite impossible for the jaw to have been opened widely. The inner articular surface hinged on the quadrate but the outer part appears to have hinged on the quadratojugal.

It is unfortunate that nothing is known of *Pantylus* except the skull. But from the skull I think we may safely conclude that it is a Cotylosaur, and in the meantime it may be safest to follow Case in keeping it as the type of a distinct suborder — the Pantylosauria.

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